Negative film

sunlight or excessive heat should be avoided. The temperature of drying cabinets should never be higher than 30° C (86° F).

Graininess of colour films

Graininess of colour films

As the silver grain is developed first in colour development — as with black and white films — and then the dye is coupled round the silver grain, so to speak, colour films also have a certain graininess. The difference to black and white films, however, consists of the fact that the colour grain is transparent and thus does not scatter the light. The "graininess" of a colour negative is not usually apparent except in very big enlargements and when the negative is examined closely. The popular opinion that colour films have no grain because they do not contain silver is therefore not in accordance with the facts.

Since Agfacolor negatives do not contain any image silver it is not always easy to distinguish the emulsion side from the back.

Sheet films are notched in the usual manner along one short side of the film. When these notches are at the top right-hand corner the emulsion faces the operator. Agfacolor negative miniature and roll films are marked along the edge with the frame number and with the emulsion batch number. When this emulsion number can be read correctly the emulsion side of the negative is facing away from the observer. If the emulsion number is known, this assists in selecting the correct printing filters more easily (see page 156).

Agfacolor negatives are particularly suitable for making enlargements on Agfacolor paper. In fact, it may generally be taken for granted that the really best results from any Agfacolor exposure are obtained in an enlargement. Contact prints do not bring out the full quality and pictorial effect of the Agfacolor process to the same extent.

To avoid disappointments and to save both time and money, it is essential to use genuine Agfacolor chemicals for processing Agfacolor negative films. Only then are consistent results guaranteed.

The above sequence of processing operations results in a negative in complementary colours from which any number of prints in natural colours can be made on Agfacolor paper or on Agfacolor Positive Film M by the printing process described in the following pages.

Printing

II. Printing

When making colour prints on paper a distinction must be drawn between prints obtained from colour negatives on Agfacolor Paper CN or MCN and those obtained from colour transparencies on Agfacolor Paper CU. For this reason both methods are dealt with separately in the following paragraphs.

Prints from negatives

a) Making prints and enlargements from Agfacolor negatives on Agfacolor paper or on Agfacolor Positive Film M

Where printing or enlarging on Agfacolor positive material is carried out to any serious extent, it is just as desirable to set aside separate workrooms for the process as in the case of negative material. This is advisable not only because of the different darkroom lighting used but also due to the fact that the solutions must not be confused or contaminated by those used for black and white photography.

Darkroom illumination

Darkroom illumination

Agfacolor paper and Positive Film M have to be panchromatically sensitized in order to record the three subtractive primary colours of the complementary colours in the Agfacolor negative. A high level of darkroom illumination such as that given by the No. 112 and 113 Agfa Safelight for black and white work is therefore out of the question. In spite of the panchromitac characteristics of Agfacolor positive materials, however, it is feasible to use a considerably higher level of illumination than that needed for panchromatic negative materials. By using the No. 166 M Agfa Safelight Filter with a 15 watt lamp at a distance of not less that 30 inches from the place of work, the material can be handled in a relatively bright olive-green illumination which is found to be very pleasant after a short time to become accustomed to it. This also simplifies considerably the printing work and other processing associated with Agfacolor positive materials.

Printers and enlargers

Printers and enlargers

In principle, all the usual printers or enlargers down to the simplest type of printing frame can be used to obtain prints on Agfacolor paper or Positive Film M. The enlargers used should, however, have lenses which

Printing

are properly corrected for colour, and since any scattered light is bound to reduce the colour brilliance of the picture, coated lenses are preferable. If the highest colour quality is desired, it is wise to stop down the enlarger lens to about f.8 and give longer exposures for the prints, since at this aperture the effect of residual uncorrected aberrations is no longer noticeable.

Whatever type of equipment is used, however, it is essential that it should be capable of accommodating the Agfacolor printing filters used to correct any colour casts in the print. There are various arrangements for introducing printing filters ranging from the more simple but not so convenient types down to those which incorporate more refinements and are easier to operate.

Filter drawer

A simple and convenient method of introducing and changing the printing filters is the filter drawer shown in fig. 57 on the following page. This consists of a drawer between the lamp and condenser to take the printing filters. This drawer should be placed as close to the condenser as possible and should be arranged so that light cannot reach the print except through the filter.

Makers of filtering attachments

Various firms supply filtering attachments for the Agfacolor process in which the filter drawer principle is incorporated. The names and addresses of these firms can be obtained from Agfa.

Where an enlarger is already available, these firms or a reasonably skilled mechanic can adapt it for Agfacolor materials by adding a filter drawer. An arrangement of this kind can also be used to supply filtered light for contact prints. In such cases the enlarger and filter drawer are used purely as a light source and ordinary printing frames containing the negative and paper are placed on the easel. Printing boxes used for black and white work can also often be adapted for Agfacolor materials by fitting a filter drawer of this kind. In such cases the filter drawer should be as close as possible to the diffusing screen and should exclude all light not passing through the filter itself. Agfacolor paper is very sensitive to light from any other sources, apart from which it produces flat colours and pure whites in the finished print. The manufacturers mentioned above also provide more complex equipment which permits quicker and simpler changing of the filters.

Colour head

A very effective and time-saving arrangement for changing the printing filters is the colour head for continuous filter control on enlargers (fig. 58)

Printing

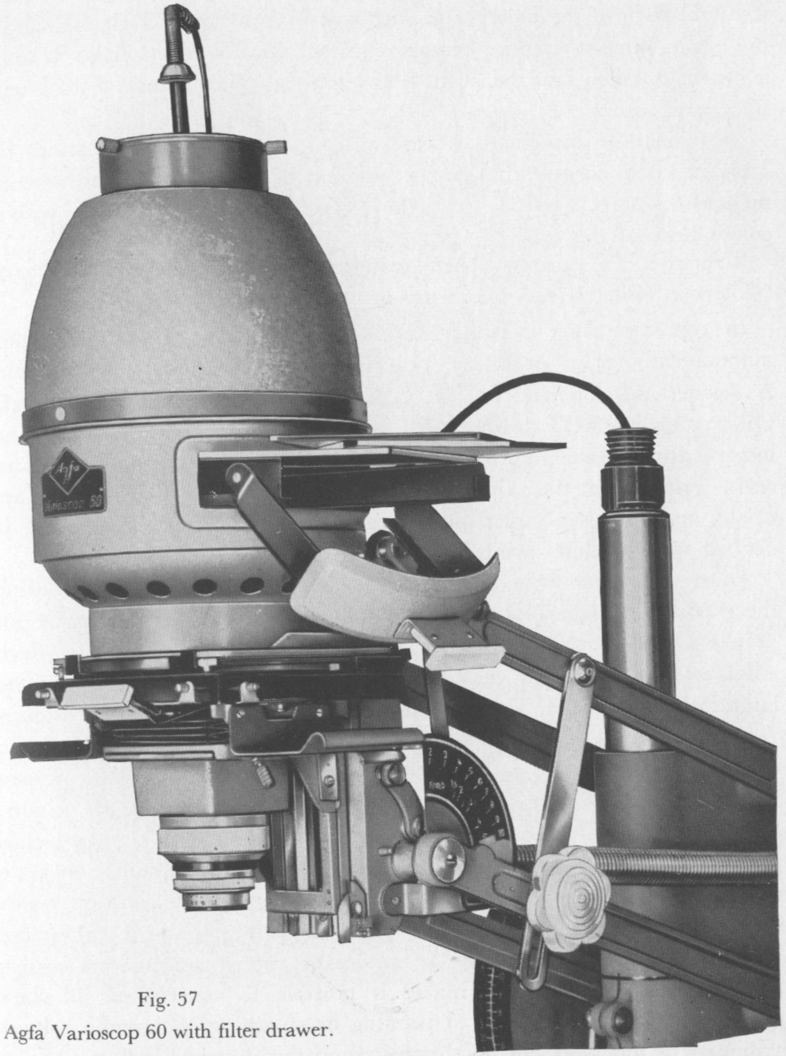

Fig. 57

Agfa Varioscop 60 with filter drawer.

made by the Agfa camera factory at Munich. The time often lost in changing the various printing filters is avoided in this case by introducing on each occasion only one printing filter of the maximum density 99 to

Printing

the light path of the enlarger in such a way as to cover various areas of the beam. When the entire beam is covered, the full effect of the 99 filter is obtained, when half the beam is covered the effect is that of a 50 unit filter, and so on.

Varioscop 60

Movement of the filters is controlled in a very simple manner by 3 rotary knobs to give continuous variation of each filter colour between nil and 99 units. Fig. 58 shows the Agfa Varioscop 60 enlarger with a colour head of this type.

Colormat

Reference has already been made on page 60 to the automatic "Colormat" filter selection attachment made by Agfa (see fig. 59).

Colormator N 2 BHT

In this case filter selection and exposure of the prints takes place automatically. The operating principle was also explained elsewhere. A further development of the Colormat is represented by the Agfa Colormator N 2 BHT printer (fig. 60) which takes rollhead paper and incorporates further improvements with regard to correction of colour casts. Printers of this kind incorporating automatic filter control are chiefly used in the larger photofinishing establishments (see section H dealing with machine prints).

Apart from the above-mentioned devices for correction filters during the exposure of Agfacolor prints, the following point must be considered:

Correcting voltage fluctuations

It is a well-known fact that the voltage of the mains supplies to which enlargers are connected may often vary considerably. This causes the lamp to burn with greater or less intensity and at the same time it changes the colour of the light. In black and white work this merely affects the exposures given to the printing paper, whereas in the Agfacolor process fluctuations in the mains voltage also affect reproduction of the colours. It is therefore highly desirable to correct fluctuations of this kind by means of a voltmeter or ammeter and resistance in the lamp circuit to regulate the required voltage or current flowing through it. A constant watch should then be kept on this instrument during printing, and it is therefore simpler in the long run to use an automatic voltage stabiliser to correct any fluctuations. This then makes it possible to concentrate all one's attention on the actual work of printing or enlarging. Automatic voltage stabilisers of this kind can be obtained from the electrical industry.

In general the technique of making Agfacolor prints or enlargements does not differ materially from that adopted in black and white work. The negative is placed in the printer or enlarger in the normal manner

Printing

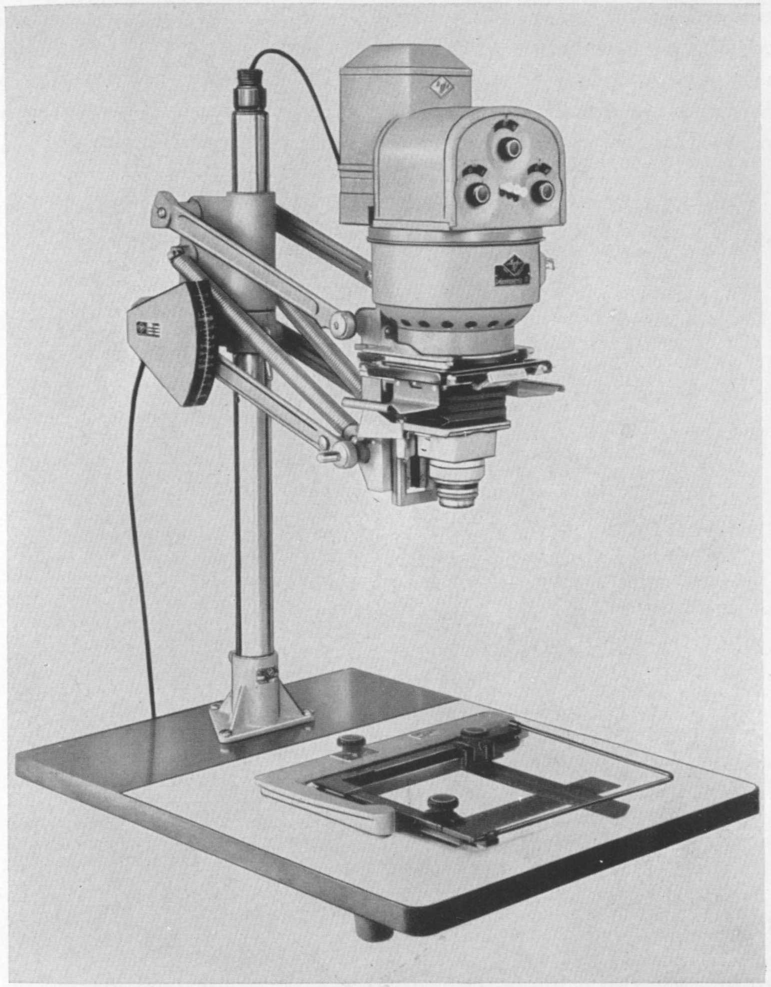

Fig. 58

Agfa Varioscop 60 with colour head for continuous filter control, illuminated magnification scale and masking frame.

Printing

and exposed on Agfacolor paper or Positive Film M just as if black and white paper were being used. Agfacolor paper has a sensitivity similar to that of Agfa Brovira, so that it is possible to make a test exposure on Brovira in the first place to determine the exposure required for Agfacolor paper. If the Brovira print is developed for exactly 90 seconds at 20° C (68° F) in Agfa Neutol or Agfa No. 100 formula, and then examined, the same exposure required for it can be used for the Agfacolor print or enlargement. The speed of Agfacolor Positive Film M is approximately twice that of Agfacolor paper, and hence twice that of Agfa Brovira paper. It equals the speed of Agfa black and white cine positive film.

Majosix

Instead of making a trial exposure on Agfa Brovira paper, a highly suitable exposure meter, the "Majosix" made by Messrs. Gossen of Erlangen, can be used for enlargements or prints.

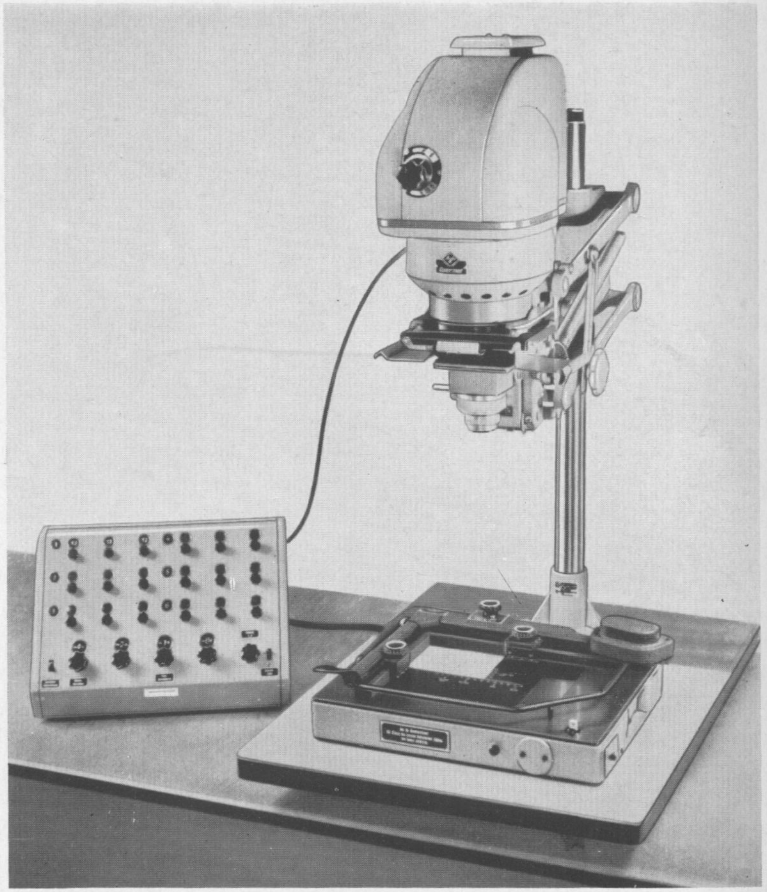

Fig. 59

The Agfa automatic Colormat enlarger with filter and exposure control.

Printing

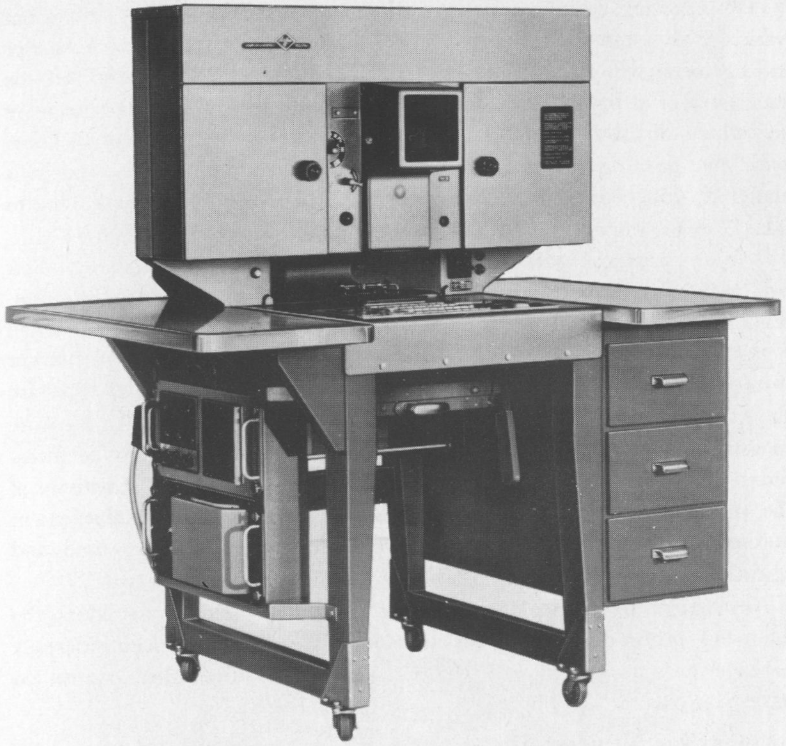

Fig. 60

Agfa roll head printer Colormator N 2 BHT with colour and exposure control.

Printing

This exposure meter consists of a photo-cell and a measuring instrument which gives a direct reading of the exposure times required for Agfacolor enlargements or prints (see fig. 61). The photo-cell is placed on the enlarging or printing surface in the densest image area of the negative for which detail is required in the positive. The measurement is taken with the printing filters already in position in the enlarger, and it is therefore unnecessary to convert exposure times as a result of having to take filter factors into account (see page 160).

Variomat

A very practical accessory for exposure control when making black and white or colour prints and enlargements is the Agfa Variomat. This measures the intensity of the light passing through the paper when it is exposed and incorporates a suitable device to ensure that the enlarger lamp is automatically switched off on reaching the required exposure time. This is thus a form of genuine exposure control and not a separate measurement of the exposure time which would then need to be transferred to the enlarger. The Variomat is set initially to the sensitivity of the particular paper and then controls the exposure of the enlargement automatically as described above, regardless of the filters used and regardless of print size up to 5 1/8 × 7 1/8 in. (see fig. 62).

Newcomers to Agfacolor processing* are first advised to adopt the following procedure which can subsequently be simplified considerably as experience is gained (see the remarks on additive filter control on page 61 et seq.):

Neutral value

1. Exposing a test strip to determine the exposure time and colour cast of what is known as a "zero print" made without correction filters (see fig. 31a plate 6, 32a plate 7, 33a plate 8). Instead of the zero print it is also possible to print a test strip using the filter combination (basic filter value) stated on the back of every package of paper, or the neutral value (see page 197). This preliminary filter combination will usually be closer to the final combination selected.

The best procedure is to note the basic filter number given on the back of the Agfacolor paper package, for example 00 30 20, to make up this combination from the printing filters and to place them in the filter

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* To be on the safe side, it is advisable for the first few tests to use the standard developed Agfacolor negative supplied with the set of printing filters II. In conjunction with the standard enlargement also supplied it is then possible to check whether the prints produced are satisfactory.

0-30-20

Printing

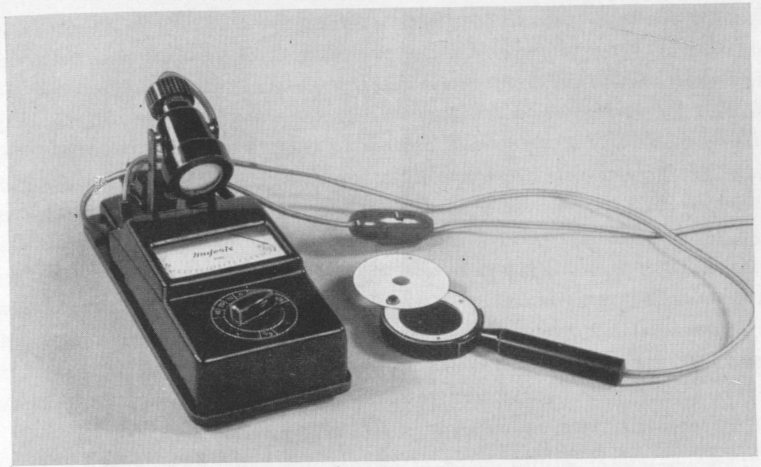

Fig. 61
"Majosix" exposure meter made by Messrs. Gossen, Erlangen.

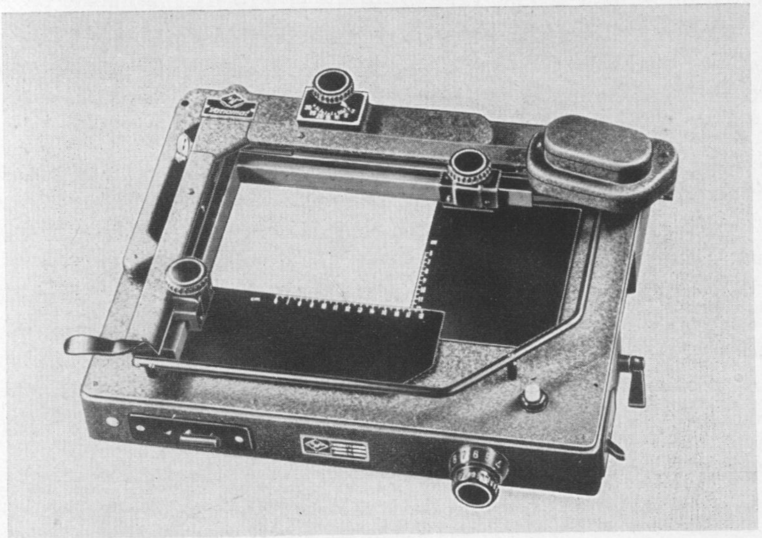

Fig. 62
Agfa Variomat C enlarger masking frame with automatic exposure control.

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drawer. To establish the exposure time required for the negative in question, a sheet of Agfacolor paper is cut up into strips and these are then subjected to different exposures. The paper used for making the test strips must be taken from the same package as that used for the final enlargement. The strips should also be big enough to include an important part of the subject in which different and typical colours occur, for example flesh tints in the case of photographs of people. The colour cast can also be easily assessed from the neutral density of the subject. The same portion of the negative is always printed on the test strips so that the strips can be compared exactly with each other. With greater experience it is possible to make a test strip with a series of different exposures as described in the footnote to page 61.

The colour cast of the zero print indicates the colour of the printing filter required (same colour printing filter as colour cast).

This operation can be omitted in the case of experienced operators since the exposure time can be estimated from the density and the likely colour cast from the colour of the negative in comparison with those from which prints have already been made.

After establishing the necessary exposure and the required colour of printing filter from these test strips, the exact density of the printing filters required will have to be determined.

2. To obtain this information, it is necessary to expose a number of test strips for which the filter combinations are arranged as far as possible in accordance with the colour cast established from the initial test strips. The differences in the filter combinations should amount to about 20 filter units, and with increasing experience in assessing a colour cast it is subsequently possible to use units of ten*. All test strips must, of course, be developed in one and the same processing operation. An example may help in explaining how these test strips for assessing the filter combinations are produced: The test strips initially printed with the basic filter combination of 00 30 20 may have had a red cast equivalent to a density

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* The illustrations on plates 26 and 27 give some idea of the colour casts which can be corrected by printing filters. Plate 26 shows colour casts of the kind which can be corrected by printing filters of density 50 in the 6 possible printing filter colours or colour combinations (yellow, magenta, cyan, red [yellow + magenta], green [yellow + cyan], blue [magenta + cyan]). Plate 27 shows colour casts in one colour (magenta) but of various intensities and indicates the densities of the magenta filter required to eliminate colour casts of this kind.

Printing

of about 50 units. The filter test strips will therefore have to be exposed through a red filter of greater density (yellow + magenta). Examples of the filter combinations used would therefore be 00 30 00, 20 50 00, 40 70 00. As a precaution it is also possible to go beyond these filter stages and to expose further test strips at filter combinations of 00 50 20, 00 70 20 and 00 90 20.

After development, one of these filter strips will be very close to the correct print with its neutral balance. The final stage then follows:

3. Exposure of the final full-size print or enlargement using the filter combination for the correct test strip or a filter combination lying between the two relatively best filter test strips. If this final print is still not quite correct, it is still possible to make further fine adjustments to the filter combination.

For the sake of clarity, the various stages are repeated in brief:

First operation: Test strips with various exposure times.

Filter combination: Basic filter value for the paper.

Exposure time: Estimated or measured (e. g. Majosix).

Second operation: Test strips with various filter combinations.

Filter combination: Estimated from the colour cast of the test strips from the first operation.

Exposure time: According to the best exposure for the first operation, but corrected for the new filter combination (see below).

Third operation: Full-size test print or enlargement.

Filter combination: Fine adjustments from the filter test strips from the second operation.

Exposure time: Corrected according to the new filter combination (see below).

The test prints and final prints cannot be assessed correctly until the final wash is completed. The prints become slightly darker on drying and this should be taken into account, where necessary, when exposing the final print (fourth operation). Apart from this, the pictorial impression given by a dry print is always slightly different to that obtained from a wet one, which means that further slight adjustments to the filter combination may still be necessary.

Fourth operation:

Production of the final print or enlargement taking into account all the corrections arising from the third operation. As further experience is

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acquired, it will occasionally be possible to omit the second and third operations, although in difficult cases it may even be necessary to include a fifth or sixth operation.

Filter factors

It will be appreciated that a change in the densities of the printing filters will result in a corresponding change in the exposure time for the various test prints or final print, because a printing filter of greater density naturally lets through less light and the exposure of the print must therefore be extended. The table of filter factors for the printing filters given on page 162 is for calculation of the exposure times needed for the glass printing filters of set I. Other tables are included in a special section at the end of the book. It should be noted that various tables are provided according to whether glass printing filters are used, printers such as the Varioscop and Seriograph incorporating an arrangement for insertion of the filters in the beam path, or the amateur type of gelatine filters. As a general rule and guide it should be noted that every increase in the density of the filter by one unit of ten results in an increase in the exposure time of about 5% for magenta, about 10% for cyan, whilst the exposure remains unchanged if the density of the yellow filter is increased. Where only one filter is first used and then a combination, the exposure time should be increased by a further 20%. This should only be regarded as a rough guide otherwise it might result in errors where greater differences in the number of filter units are involved.

Greater accuracy is therefore obtained with Agfacolor printing filters when the filter factor tables for extension of the exposure are applied. The filter combinations in the following examples have been taken from table "a" for the large set of filters.

When using a filter of one colour only, the exposure factor by which the correct exposure from the test strip must be multiplied is given in the column directly alongside or below the filter density selected. Thus, for yellow filters of all densities, an exposure factor of 1.2 is applicable; a magenta filter of 40 units (i.e. 00 40 00) needs a factor of 1.5, and a cyan 70 unit filter (00 00 70) requires a factor of 2.3. In other words, the exposure time found to be correct for the unfiltered print should be multiplied by the appropriate factor of the filter used. If, for example, the original exposure indicated as correct by the test strip were 16 sec., the use of the 00 00 70 filter would mean that an exposure of 16 × 2.3 = 36.8 sec. (37 sec.) would be required for the final print.

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Combinations of filters are dealt with in a similar manner. If using a combination of 10 20 00, the exposure factor is found by moving downwards from the top of the yellow and magenta column until the horizontal row for a 20 unit filter is reached (factor of 1.5). For the combination 30 50 00, one starts at the 30 unit square for magenta on the left and moves horizontally along until vertically below the 50 unit square in the cyan row, to find the factor 2.6.

All these factors relate to the correct exposure determined without using filters. If the correct exposure has been determined for a given filter or filter combination, and it then proves necessary to alter this combination, the new exposure value can be determined roughly by the rule of thumb method of percentages given above. To work more accurately, the altered exposure for the correct filter combination can also be determined by first calculating the exposure for the unfiltered print and then multiplying this by the new filter factor. Let us take the following example: The correct exposure for a 00 30 70 filter combination is known to be 19 sec. but it is necessary to correct this and use a combination of 00 50 70. The table shows the filter factor for 00 30 70 to be 3.1, and by dividing the known exposure of 19 seconds by 3.1 the correct unfiltered exposure of 6.3 seconds is obtained. For the filter combination 00 50 70, however, the exposure factor is 3.5, so that an exposure of 6.1 × 3.5 = 21.5 sec. will be necessary. Those who are practised in mathematics will probably make this calculation by dividing the factor for the new filter combination by the factor for the original combination and then multiplying the correct exposure of the first print by the results. For the purpose of the example this would give

$$\frac{3.5}{3.1} = 1.13 \qquad 1.13 \times 19 = 21.5 \text{ sec.}$$

Filter slide rules

For rapid work on these lines the usual types of slide-rule or disk-shaped slide-rules can be used, and also the Agfa filter computing wheel.

Over-filtering

As already explained, the function of the printing filter is that of correcting the colour balance of the print and removing colour casts. In carrying out such corrections, however, it is quite possible to overcorrect